If the temperature of the ozone layer is high, as now generally believed and here assumed, then clearly there must be marked vertical convection above it and a correspondingly rapid decrease of temperature with increase of height, or lapse rate, until that particular temperature is reached at which the loss of heat through radiation by a unit mass of the air is equal to its gain of heat by absorption of radiation, at which level a second, or upper, stratosphere will begin.

What the temperature of this second stratosphere is we do not know, but presumably it is lower than that of the first, or under, stratosphere because, mass for mass, its coefficient of absorption is less—less, by experiment, owing to its smaller pressure; and less, by theory at least, owing to its already lower temperature—theory indicating that absorption of radiation by a gas or vapor must decrease with decrease of temperature. At any rate, its temperature may, it seems, be quite low enough to occasionally permit of the formation of super cirrus clouds in its upper portion of sufficient density to be seen when illuminated by the sun while all the lower atmosphere is in the shadow of the earth and therefore free from glare.

As others have suggested, it may be that the water vapor put into the upper air by violent volcanic eruptions has been an important contributing factor to the production of the noctilucent cloud. Such explosions also add condensation nuclei to this high region, though that may be "carrying coals to Newcastle." We may assume that the volcanic water vapor is driven, partly by explosion but chiefly by convection incident to its own high temperature, into the warm ozone layer where none of it would condense, the temperature being too high, and that from there portions of it are carried on up by the convection that persistently must obtain in that region to the level of condensation.

But, we ask, can the water vapor of this source be worth considering—be more than the proverbial "drop in the bucket"? Perhaps so, for the quantity of water vapor given off by volcanoes is very great. It has been estimated, for instance, that during a certain consecutive 18 hours Vesuvius gave out enough water vapor to make a cubic kilometer of liquid water, an amount that would be many drops in the outer air bucket.

It is possible that carbon dioxide may have some part in, or be alone responsible for, the formation of the noctilucent cloud, but not likely, since to solidify it from an atmosphere in which it exists in the usual volume proportion of 3 to 10,000, and at the low pressure that certainly prevails at the height of 80 kilometers, would require a temperature of the order of only 100° A., a much lower temperature than we have any reason to expect at that level, and much lower, apparently, than would be sufficient to produce a cloud of ice particles.

If the above ideas are substantially correct, then the atmosphere consists of the following great divisions, counting from the surface up, namely: Troposphere, stratosphere, ozoneosphere, altotroposphere, and altostratosphere.

MORNING SHOWERS OVER THE GULF, AND AFTERNOON SHOWERS IN THE INTERIOR NEAR CORPUS CHRISTI, TEX.

By J. P. McAuliffe

[Weather Bureau Office, Corpus Christi, Tex.]

A peculiar type of local shower condition occurs near Corpus Christi, Tex., during the summer months, and has such marked characteristics that it has attracted the attention of meteorologists, and sportsmen who visit this coast.

Following an almost cloudless night thundershowers begin forming off-shore over the Gulf about 3 to 4 a.m., and move slowly inland. As they advance toward shore these thundershowers break up into two main storms, one moving northwestward, and the other southwestward, invariably advancing toward the nearest land areas, which are in the directions mentioned. Very few of the storms move directly westward toward Corpus Christi Bay, nearly all appearing to avoid that water area. It is for this reason that the Weather Bureau rain gage records very little precipitation from these showers, as the gage is located on the roof of the Federal Building in down-town Corpus Christi about 1,000 feet west of the Bay. Copious showers occur northeast and southeast of the city during the early morning hours and often the thunderstorms become heavy. Drifting slowly westward these shower conditions reach the interior during the midday and afternoon, and copious and sometimes torrential showers occur north, west, and south of Corpus Christi. During the latter part of the afternoon the clouds dissipate, and by sunset the sky is usually cloudless. This condition is usually repeated 2 or 3 days in succession. The showers are scattered and moderate the first day, more general and heavier the second day, gradually decreasing in intensity and area until the third or fourth day, when no more occur.

When these showers prevail, the early morning air is sultry and the wind generally light, sometimes calm. When the showers reach the shore north and south of the city a moderate breeze that is unusually cool and invigorating comes in from the sea, and the air over the Gulf becomes clear, with visibility unusually good.

An outstanding feature of these thunderstorms is the time of commencement which is almost invariably within the hour following 4 a.m. First thunder usually is heard between 4 and 5 a.m., and the first shower reaches the mainland about 5:30 to 6 a.m. They also traverse almost identical paths as they approach the interior, and for that reason localities along that path have successive days with moderate to excessively heavy rains. In the main the showers are unwelcome, because they come in the cotton-picking season, and delay picking in the areas affected.

It seems that the same general cause, local convection, is responsible for the showers over the Gulf, before sunrise, and over the interior as the day progresses. Since the air is warmer by night over the Gulf than over the land thunderstorms then develop offshore; but as the soil becomes warmer than the water during the day the convection and consequent thunderstorms then occur inland.

Why the showers avoid the crescent-shaped Corpus Christi Bay is not fully understood. The theory is that the land breeze, coming from higher elevations (from sea level to 200 feet within 40 miles westward) converges as a rather strong descending and cool current over the Corpus Christi Bay region, cutting off convectional action in that area, and acting as a barrier to the advancing thunderstorm.[1]

The first showers are practically impossible to forecast, as there is no condition on the weather map to indicate when they will occur. After the rains have started, however, one may assume that the same condition will be repeated the following day, and probably the third day, and forecast accordingly.

[1] The course of the flow of the free air, hence direction of travel of a distrubance in it, is from "source" to "sink"; in this case from water to land. Therefore a storm headed toward the mouth of the bay is likely to be divided into two branches, each moving to, and then over, its nearest land surface.—Editor.